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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/799,811

03/12/2004

Randy L. Hoffman

200316545

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09/27/2006

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EXAMINER

LANDAU, MATTHEW C

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 09/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/799,811	<b>Applicant(s)</b> HOFFMAN ET AL.	
	<b>Examiner</b> Matthew Landau	<b>Art Unit</b> 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 17 July 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-46 is/are pending in the application.
- 4a) Of the above claim(s) 17-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 14-16, 31-33, 36-43 and 46 is/are rejected.
- 7) ☒ Claim(s) 10-13, 34, 35, 44 and 45 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>5/8/2006</u> | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Election/Restrictions***

Claims 17-30 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

### ***Specification***

Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

It is suggested the abstract be changed from "A semiconductor device can have..." to "A semiconductor device ~~can have~~ comprising..."

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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Claims 3, 15, and 46 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 3, the limitation "the channel includes at least one of an amorphous form, a single-phase crystalline form, and a mixed-phase crystalline form" renders the claim indefinite. The independent claim (claim 1) as amended recites, "at least one metal oxide of the channel is of an amorphous form". It is unclear how the channel can be both amorphous (as required by claim 1) and crystalline; it must be either one or the other. Note that claims 15 and 46 have the same problem.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5, 14-16, 31, 32, 36-41, and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cillessen et al. (US Pat. 5,744,864, hereinafter Cillessen) in view of Kingery et al. (US Pat. 3,294,660, hereinafter Kingery).

Regarding claims 1, 3, 31, 36, and 46, Figures 1 and 2 of Cillessen discloses a semiconductor device, comprising: a drain electrode (2 or 3); a source electrode (2 or 3); a channel 4 contacting the drain electrode and the source electrode, wherein the channel includes

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one or more of a metal oxide including zinc-gallium (col. 5, lines 34-42, especially line 42); a gate electrode 5; and a gate dielectric 6 positioned between the gate electrode and the channel. The difference between Cillessen and the claimed invention is the metal oxide is amorphous. Kingery discloses a semiconductor film made of an amorphous metal oxide (col. 4, lines 1-7). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Cillessen by using an amorphous metal oxide (including zinc-gallium) for the purpose of allowing the film to be used in higher temperatures (see col. 1, lines 19-27 of Kingery). Regarding claim 31, the various method steps, including the limitations “providing a precursor composition...” and “depositing a channel including the precursor composition...” are merely product-by-process limitations that do not structurally distinguish the claimed invention over the prior art, since Cillessen and Kingery disclose all the claimed structural features. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966. Regarding claim 36, Cillessen further discloses applying a voltage to the gate electrode to effect a flow of electrons through the channel (col. 5, lines 25-29).

Regarding claims 2, 5, and 41, Cillessen discloses the metal oxide in the channel is  $\text{InGaO}_3$  (col. 5, lines 40-42). Therefore, the atomic composition of In (metal A) is 0.2 and the atomic composition of Ga (metal B) is 0.2.

Regarding claim 4, Figures 1 and 2 of Cillessen discloses the metal oxide includes zinc-gallium-oxide (col. 5, lines 34-42).

Regarding claims 14 and 15, Figures 1 and 2 of Cillessen discloses a semiconductor device, comprising: a drain electrode (2 or 3); a source electrode (2 or 3); a means for controlling the current flow (channel region 4) electrically coupled to the drain electrode and the source electrode; and a gate electrode 5 separated from the channel by a gate dielectric 6. The difference between Cillessen and the claimed invention is the metal oxide is amorphous. Kingery discloses a semiconductor film made of an amorphous metal oxide (col. 4, lines 1-7). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Cillessen by using an amorphous metal oxide (including zinc-gallium) for the purpose of allowing the film to be used in higher temperatures (see col. 1, lines 19-27 of Kingery).

Regarding claims 16 and 40, Cillessen discloses the source (2 or 3), drain (2 or 3), and gate electrode 5 includes a substantially transparent material (col. 4, lines 27-29 and 35-37).

Regarding claim 32, the limitation “wherein the step for depositing a channel includes an ink-jet deposition technique” is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966.

Regarding claim 37, Cillessen discloses the semiconductor device (transparent switching element) is used as a switch in a display device (col. 2, line 63 – col. 3, line 9).

Regarding claim 38, it is inherent that the electrons conduct through the channel in a linear region of operation, since the channel is a linear region.

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Regarding claim 39, Figures 1, 2, and 8 of Cillessen disclose a display device (Figure 8), comprising: a plurality of pixel devices 30 configured to operate collectively to display images, where each of the pixel devices includes a semiconductor device 1 configured to control light emitted by the pixel device, the semiconductor device including: a drain electrode (2 or 3); a source electrode (2 or 3); a channel 4 contacting the drain electrode and the source electrode, wherein the channel includes one or more of a metal oxide including zinc-gallium (col. 5, lines 34-42, especially line 42); a gate electrode 5; and a gate dielectric 6 positioned between the gate electrode and the channel and configured to permit application of an electric field to the channel. The difference between Cillessen and the claimed invention is the metal oxide is amorphous. Kingery discloses a semiconductor film made of an amorphous metal oxide (col. 4, lines 1-7). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Cillessen by using an amorphous metal oxide (including zinc-gallium) for the purpose of allowing the film to be used in higher temperatures (see col. 1, lines 19-27 of Kingery).

Claims 1-9 and 31-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohta et al. ("Frontier of transparent oxide semiconductors", hereinafter Ohta) in view of Kingery.

Regarding claims 1, 3, 4, 8, 6, 31, and 33, Ohta discloses a field-effect thin-film transistor (TFT) (see section 4.2), which inherently has a drain electrode, a source electrode, a channel, a gate electrode, and a gate dielectric between the gate electrode and the channel. Note that Ohta

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specifically discloses a gate insulator (section 4.2). Ohta further discloses the channel includes single-crystal  $\text{InGaO}_3(\text{ZnO})_5$  (section 4.2). Regarding claim 6,  $\text{Zn}=\text{A}$ ,  $\text{In}=\text{B}$ , and  $\text{Ga}=\text{C}$ . The difference between Ohta and the claimed invention is the metal oxide is amorphous. Kingery discloses a semiconductor film made of an amorphous metal oxide (col. 4, lines 1-7). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Ohta by using an amorphous metal oxide (including zinc-gallium) for the purpose of allowing the film to be used in higher temperatures (see col. 1, lines 19-27 of Kingery). Regarding claim 31, the various method steps, including the limitations “providing a precursor composition...” and “depositing a channel including the precursor composition...” are merely product-by-process limitations that do not structurally distinguish the claimed invention over the prior art, since Ohta and Kingery disclose all the claimed structural features. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966.

Regarding claims 2, 5, 7, and 9, as stated above, Ohta discloses the metal oxide in the channel is  $\text{InGaO}_3(\text{ZnO})_5$ , which is equivalent to  $\text{InGaZn}_5\text{O}_8$ . Therefore, Ohta discloses the atomic composition of each metal is as follows: A is approximately 0.33, B is approximately 0.07, C is approximately 0.07.

Regarding claim 32, the limitation “wherein the step for depositing a channel includes an ink-jet deposition technique” is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art. The patentability of a product does not



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depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966.

Claims 39-43 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawasaki et al. (US Pat. 6,727,522, hereinafter Kawasaki) in view of Ohta and Kingery.

Regarding claims 39, 42, and 46, Figure 1A of Kawasaki discloses a semiconductor including: a drain electrode 13; a source electrode 12; a channel 11 contacting the drain electrode and the source electrode, wherein the channel includes metal oxide (ZnO) (col. 3, line 33-35); a gate electrode 14; and a gate dielectric 15 positioned between the gate electrode and the channel and configured to permit application of an electric field to the channel. Kawasaki discloses the device is used as a switching element in liquid crystal display (LCD) device (col. 9, lines 25-35). It is known that an LCD device comprises a plurality of pixel devices configured to operate collectively to display images, where each of the pixel devices includes a switching device configured to control light emitted by the pixel device. The difference between Kawasaki and the claimed invention is the channel includes one or more compounds of the formula  $A_xB_xC_xO_x$ , wherein each A is selected from the group of Zn, Cd, each B is selected from the group of Ga, In, each C is selected from the group of Zn, Cd, Ga, In, each O is atomic oxygen, each x is independently a non-zero integer, and wherein each of A, B, and C are different. Ohta discloses a transparent FET wherein the channel includes  $\text{InGaO}_3(\text{ZnO})_5$  (see section 4.2). In this case,

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Zn=A, In=B, and Ga=C. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawasaki by using  $\text{InGaO}_3(\text{ZnO})_5$  in the channel for the purpose of providing good controllability of carrier concentration (see section 4.2 of Ohta). A further difference between Kawasaki and the claimed invention is the metal oxide is amorphous. Kingery discloses a semiconductor film made of an amorphous metal oxide (col. 4, lines 1-7). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Kawasaki by using an amorphous metal oxide (including zinc-gallium) for the purpose of allowing the film to be used in higher temperatures (see col. 1, lines 19-27 of Kingery).

Regarding claim 40, Kawasaki discloses the source 12, drain 13, and the gate 14 electrodes include a substantially transparent material (col. 3, lines 50-55).

Regarding claims 41 and 43, after the above combination, the metal oxide in the channel is  $\text{InGaO}_3(\text{ZnO})_5$ , which is equivalent to  $\text{InGaZn}_5\text{O}_8$ . Therefore, Kawasaki in view of Ohta discloses the atomic composition of each metal is as follows: A (Zn) is approximately 0.33, B (In) is approximately 0.07, C (Ga) is approximately 0.07.

#### ***Allowable Subject Matter***

Claims 10-13, 34, 35, 44, and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

Applicant's arguments with respect to the pending claims have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (571) 272-1731.

The examiner can normally be reached from 8:30 AM - 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be

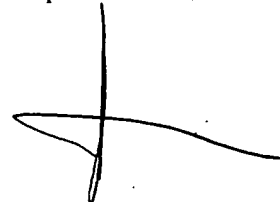
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reached on (571) 272-2298. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and (571) 273-8300 for After Final communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should any questions arise regarding access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew C. Landau

September 21, 2006

A handwritten signature in black ink, appearing to be 'K Parker', written over a vertical line.

KENNETH PARKER  
SUPERVISORY PATENT EXAMINER